

Operating instructions

LABORATORY - MORTAR MILL

PULVERISETTE 2

Valid starting with: 02.2000/101



Read the instructions prior to performing any task!

Translation of the original operating instructions

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Certifications and CE conformity

Certification

Fritsch GmbH has been certified by the TÜV-Zertifizierungsgemeinschaft e.V.



An audit certified that Fritsch GmbH conforms to the requirements of the DIN EN ISO 9001:2008.

CE Conformity

The enclosed Conformity Declaration lists the guidelines the FRITSCH instrument conforms to, to be able to bear the CE mark.



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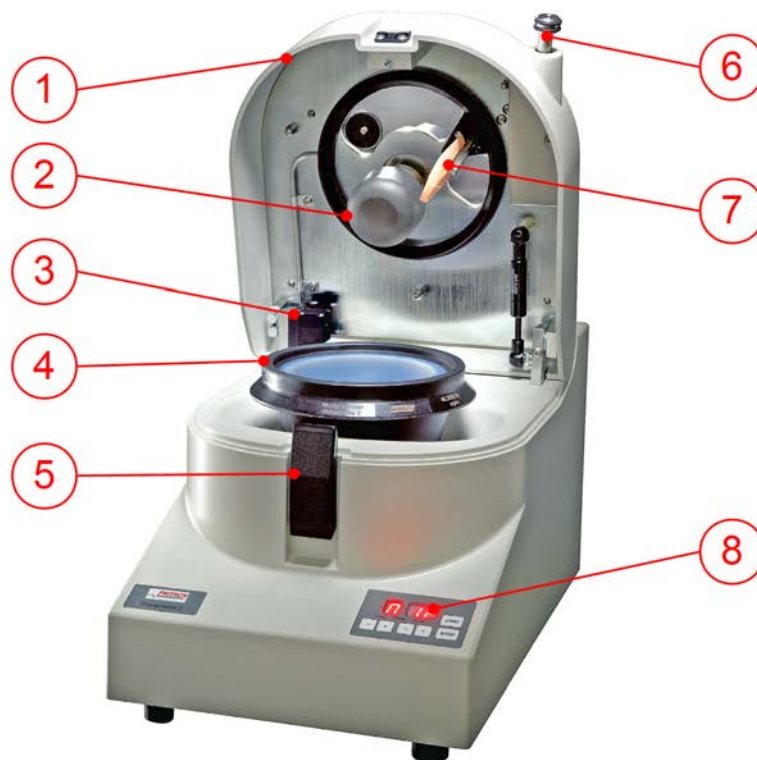
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Basic structure

1 Basic structure



- 1 Lid
- 2 Pestle
- 3 Lid safety switch
- 4 Mortar

- 5 Latch
- 6 Pressure regulator, pestle against mortar wall
- 7 Scraper
- 8 Control panel

2 Safety information and use

2.1 Requirements for the user

This operating manual is intended for persons assigned with operating and monitoring the Fritsch PULVERISETTE 2. The operating manual and especially its safety instructions are to be observed by all persons working on or with this device. In addition, the applicable rules and regulations for accident prevention at the installation site are to be observed. Always keep the operating manual at the installation site of the PULVERISETTE 2.

People with health problems or under the influence of medication, drugs, alcohol or exhaustion must not operate this device.

The PULVERISETTE 2 may only be operated by authorised persons and serviced or repaired by trained specialists. All commissioning, maintenance and repair work may only be carried out by technically qualified personnel. Qualified personnel are persons who, because of their education, experience and training as well as their knowledge of relevant standards, regulations, accident prevention guidelines and operating conditions, are authorised by those responsible for the safety of the machine to carry out the required work and are able to recognize and avoid possible hazards as defined for skilled workers in IEC 364.

In order to prevent hazards to users, follow the instructions in this manual.

Malfunctions that impair the safety of persons, the PULVERISETTE 2 or other material property must be rectified immediately. The following information serves both the personal safety of operating personnel as well as the safety of the products described and any devices connected to them: All maintenance and repair work may only be performed by technically qualified personnel.

This operating manual is not a complete technical description. Only the details required for operation and maintaining usability are described.

Fritsch has prepared and reviewed this operating manual with the greatest care. However, no guarantee is made for its completeness or accuracy.

Subject to technical modifications.

2.2 Scope of application

The PULVERISETTE 2 mortar mill is used for universal dry and wet grinding to achieve analytical fineness.

During the synthesis, it is used for mixing or homogenising dry samples, emulsions or pastes.

It grinds inorganic and organic samples for analysis, quality control or material testing in applications such as:

Safety information and use

Mining/Metallurgy	Ores, coal, coke, slags
Chemistry	Fertilizers, dyes, pesticides, salts, detergents, synthetic resins
Geology/Mineralogy	Rocks (up to Mohs hardness 9), calcites, quartz, silicates
Glass	Sand, frits, glass, raw materials
Ceramics	Porcelain, fire clay, sintered ceramics, clay
Agriculture	Ground samples, fertilizers, leaves, plants
Food	Candy, gelatin, spices, yeast, pasta, sugar
Metallurgy	Bauxite, slags, granulates
Pharmacy	Dragées, drugs, pills, pastes
Rocks/Soils	Plaster, lime, clinker, sand, cement

2.2.1 Operating principle



As with a hand mortar and pestle, the grinding stock is ground in the laboratory mortar mill under the influence of pressure and friction. Unlike the hand mortar and pestle, the mortar of the laboratory mortar mill is driven - the pestle axis is mounted on a rotating bearing and can be shifted horizontally. The relatively large pestle ensures fast and consistent grinding and crushing of sample material.

Extremely sticky or adhesive material can be ground as a suspension by adding liquid. The liquid can be added or topped up during grinding.

The grinding probe is picked up by the rotating mortar, scraped from its edge by a Vulkollan scraper, flipped in a plough-like motion and returned to the pestle.

In contrast to the usually flat hand mortars, the grinding chamber of the deep mortar bowl is closed in the laboratory mortar mill and sealed by a rubber lip, enabling comminution with hardly any loss.

Configurable grinding duration and contact pressure of the pestle ensure reproducible grinding conditions - while the grinding progress can be viewed through a plexiglas window.

The extraordinary heavy-duty design of the drive, the pestle guide and all movable parts guarantee operational readiness throughout the long service life of the laboratory mortar mill.

2.3 Obligations of the operator

Before using the PULVERISETTE 2, this manual is to be carefully read and understood. The use of the PULVERISETTE 2 requires technical knowledge; only commercial use is permitted.

The operating personnel must be familiar with the content of the operating manual. For this reason, it is very important that these persons actually receive the present operating manual. Ensure that the operating manual is always near the device.

The PULVERISETTE 2 may exclusively be used within the scope of applications set down in this manual and within the framework of guidelines put forth in this manual. In case of non-compliance or improper use, the customer assumes full liability for the functional capability of the PULVERISETTE 2 and for any damage or injury arising from failure to fulfil this obligation.

By using the PULVERISETTE 2 the customer agrees with this and recognizes that defects, malfunctions or errors cannot be completely excluded. To prevent risk of damage to persons or property or of other direct or indirect damage, resulting from this or other causes, the customer must implement sufficient and comprehensive safety measures for working with the PULVERISETTE 2.

Neither compliance with this manual nor the conditions and methods used during installation, operation, use and maintenance of the PULVERISETTE 2 can be monitored by Fritsch GmbH. Improper execution of the installation can result in property damage and thus endanger persons. Therefore, we assume absolutely no responsibility or liability for loss, damage or costs that result from errors at installation, improper operation or improper use or improper maintenance or are in any way connected to these.

The applicable accident prevention guidelines must be complied with.

Generally applicable legal and other obligatory regulations regarding environmental protection must be observed.

2.4 Information on hazards and symbols used in this manual

Safety information

Safety information in this manual is designated by symbols. Safety information is introduced by keywords that express the extent of the hazard.



DANGER!

This symbol and keyword combination points out a directly hazardous situation that can result in death or serious injury if not avoided.

Safety information and use



WARNING!

This symbol and keyword combination points out a possibly hazardous situation that can result in death or serious injury if not avoided.



CAUTION!

This symbol and keyword combination points out a possibly hazardous situation that can result in slight or minor injury if not avoided.



NOTICE!

This symbol and keyword combination points out a possibly hazardous situation that can result in property damage if not avoided.



ENVIRONMENT!

This symbol and keyword combination points out a possibly hazardous situation that can result in environmental damage if not avoided.

Special safety information

To call attention to specific hazards, the following symbols are used in the safety information:



DANGER!

This symbol and keyword combination points out a directly hazardous situation due to electrical current. Ignoring information with this designation will result in serious or fatal injury.



DANGER!

This symbol and keyword combination designates contents and instructions for proper use of the machine in explosive areas or with explosive substances. Ignoring information with this designation will result in serious or fatal injury.

Safety information and use



DANGER!

This symbol and keyword combination designates contents and instructions for proper use of the machine with combustible substances. Ignoring information with this designation will result in serious or fatal injury.



WARNING!

This symbol and keyword combination points out a directly hazardous situation due to movable parts. Ignoring information with this designation can result in hand injuries.



WARNING!

This symbol and keyword combination points out a directly hazardous situation due to hot surfaces. Ignoring information with this designation can result in serious burn injuries due to skin contact with hot surfaces.

Safety information in the procedure instructions

Safety information can refer to specific, individual procedure instructions. Such safety information is embedded in the procedure instructions so that the text can be read without interruption as the procedure is being carried out. The keywords described above are used.

Example:

1. ➔ Loosen screw.

2. ➔



CAUTION!

Risk of entrapment at the lid.

Close the lid carefully.

3. ➔ Tighten screw.

Tips and recommendations







This symbol emphasises useful tips and recommendations as well as information for efficient operation without malfunction.

Further designations

To emphasise procedure instructions, results, lists, references and other elements, the following designations are used in this manual:

Safety information and use

Designation	Explanation
 1., 2., 3. ...	Step-by-step procedure instructions
	Results of steps in the procedure
	References to sections in this manual and relevant documentation
	Lists without a specific order
[Button]	Operating elements (e.g. push button, switch), display elements (e.g. signal lamps)
'Display'	Screen elements (e.g. buttons, function key assignment)

2.5 Device safety information

Please observe!

- Only use original accessories and original spare parts. Failure to observe this instruction can compromise the safety of the machine.
- Accident-proof conduct is to be strictly followed during all work.
- Comply with all currently applicable national and international accident prevention guidelines.



CAUTION!

Wear hearing protection!

If a noise level of 85 dB(A) is reached or exceeded, ear protection should be worn to prevent hearing damage.



WARNING!

The maximum accepted concentration (MAC) levels of the relevant safety guidelines must be observed; if necessary, ventilation must be provided or the machine must be operated under an extractor hood.

Safety information and use



DANGER!

Explosion hazard!

- When grinding oxidizable substances, e.g. metals or coal, there is a risk of spontaneous combustion (dust explosion) if the share of fine particles exceeds a certain percentage. When grinding these kinds of substances, special safety measures must be taken and the work must be supervised from a specialist.
- The PULVERISETTE 2 is not explosion protected and is not designed to grind explosive materials.

- Do not remove the information signs.



NOTICE!

Immediately replace damaged or illegible information signs.

- Unauthorised alteration of the PULVERISETTE 2 will void Fritsch's declaration of conformity to European directives and void the guarantee.
- Only use the PULVERISETTE 2 when it is in proper working order, as intended and in a safety- and hazard-conscious manner adhering to the operating manual. In particular, immediately rectify any malfunctions that could pose a safety hazard.
- If, after reading the operating manual, there are still questions or problems, please do not hesitate to contact our specialised personnel.

2.6 Protective equipment



Protective equipment is to be used as intended and may not be disabled or removed.

All protective equipment is to be regularly checked for integrity and proper functioning.

A hood safety switch (3) is installed to ensure that grinding is interrupted when the hood is opened during operation.



The laboratory mortar mill will not start when the hood is open!

Safety information and use

2.7 Hazardous points



CAUTION!

- Crushing hazard when closing the grinding chamber!
- Crushing hazard when closing the latch (5)!
- Crushing hazard when inserting the mortar!

2.8 Electrical safety

- The main switch on the back of the device separates the device from the mains on two poles.

2.8.1 Overload protection

- The device switches off if there is an overload! (See ↗ 'Repairs' on page 36)

3 Technical data

3.1 Dimensions

410 x 310 x 460 mm (height x width x depth)

3.2 Weight

24 kg (net)

34 kg (gross)

3.3 Operating noise

Emissions value of workplace according to DIN EN ISO 3746:2005 $L_{pa} = 49.5$ dB(A). The noise level measurement was conducted with feed pellets as grinding stock and grinding elements made of agate!

3.4 Voltage

The device can be operated in two voltage ranges:

- Single phase alternating current 100-120 V \pm 10%
- Single phase alternating current 200-240 V \pm 10%

Transient overvoltage according to overvoltage category II is permitted.

3.5 Current consumption

The maximum current consumption is approx. 0.8 A at 200-240 V, 1.8 A at 100-120 V.

3.6 Electrical fuses

The following are on the back of the device are:

- A fuse in the mains supply unit.
- Overload protection for the drive motor.

3.7 Material

The feeding size and quantity of the grinding stock should not exceed 6 - 8 mm and 190 ml respectively. The optimum sample quantity is around 150 ml. (Crush larger sample pieces beforehand, if necessary.)

Technical data

3.8 Final fineness

The final fineness depends on the grinding duration - sufficiently long grinding times can yield an average particle feed size of 10 µm.

4 Installation

4.1 Transport

**WARNING!**

Improper lifting can lead to personal injury or property damage. The machine is only to be lifted with suitable equipment and by qualified personnel.

The device is delivered on a transport pallet with a wooden hood or in a cardboard box.

The guarantee excludes all claims for damage due to improper transport.

4.2 Unpacking

- Pull out the nails that fasten the hood to the transport pallet. The hood is the wooden case that has been placed over the transport pallet.
- Lift the hood off the transport pallet.
- If the PULVERISETTE 2 was delivered in a cardboard box, open the box carefully with a knife.

**WARNING!****Crushing hazard!**

Always lift with 2 persons.

Hold the bottom edge of the housing when lifting.

- Compare the contents of the delivery with your order.
- The scraper and the fastening screw are in a plastic bag in the grinding chamber. Take them out!

4.3 Setting up

Place the mortar mill on a flat, stable surface. It does not have to be fastened to this surface.

- Make sure that the mortar mill is easily accessible.
- Control elements on the back of the device (mains switch) must be easily accessible.
- Keep the air outlet free from obstructions on the side ventilation grate. Risk of overheating!

Installation



NOTICE!

Before commissioning, take all loose parts out of the grinding chamber!

4.4 Ambient conditions



WARNING!

Mains voltage!

- The device may only be operated indoors.
- The surrounding air may not carry any electrically conductive dust.
- Maximum relative humidity 80% for temperatures up to 31°C, linearly decreasing down to 50% relative humidity at 40°C.

- The room temperature has to stay between 5 - 40°C.
- Altitudes up to 2000 m
- Degree of pollution 2 according to IEC 664.

4.5 Electrical connection

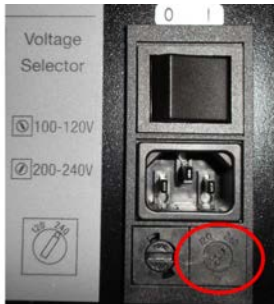
Before establishing the connection, compare the voltage and current values stated on the type plate with the values of the mains system to be used.



CAUTION!

Ignoring the values on the type plate may result in damage to the electrical and mechanical components.

4.5.1 Adjusting the mains voltage




Only qualified personnel are allowed to change the voltage range on the device.

- 1.** ➤ Disconnect the device from the mains.
- 2.** ➤ Set the voltage switch (on the back of the device) to the voltage of the mains supply.
- 3.** ➤ Connect the device to the mains.

Initial start-up

5 Initial start-up

Perform initial start-up only after all work as described in  'Installation' on page 17 has been carried out.

5.1 Switching on



1. ➤ Connect the device to the mains.
2. ➤ Switch on the device using the mains switch (on the back of the device).
3. ➤ The display of the digital timer lights up red.

5.2 Function check

1. ➤ Close the hood.
2. ➤ The laboratory mortar mill starts to work as soon as the START button is pressed.

5.3 Switching off

1. ➤ Press the STOP button.
2. ➤ Disconnect the device from the mains at the mains switch (on the back of the device).

6 Using the device



WARNING!

If the grinding elements used are not original accessories, we provide no guarantee and exclude all liability for damage to the device.

The laboratory mortar mill only works/starts with the lid closed. The device shuts down if the lid is opened during operation. The device cannot be started with the lid open.

6.1 Timer

After starting the device (main switch on the back of the device), the timer shows the time setting of the preceding grinding process.

The integrated timer makes it possible to program a grinding duration of 1 s to 9 h 59 min. It is not possible to program non-stop operation.

The mill basically has two modes of operation:

- Hour mode (display of hours and minutes)
- Minute mode (display of minutes and seconds)
- Factory setting: Hour mode

1st segment indicates the full hours,

2nd and 3rd segments indicate the minutes.

The example illustrated here shows a grinding duration of 5 min.



6.1.1 Displaying/changing the mode of operation

Keep the STOP button pressed while switching on the device via the main switch (back of device).

The right display indicates whether the device is set to hour mode (-) or minute mode (I).

By pressing the right button " + " (multiple times), it is possible to toggle between hour mode (-) and minute mode (I).

6.1.2 Switching to normal mode

Pressing the STOP button switches the device to normal mode and the currently programmed operating mode is accepted.

Using the device

6.1.3 Setting the grinding duration

The desired grinding duration can be set with the "+" and "-" buttons. Depending on the set operating mode, the display indicates hours/minutes or minutes/seconds.

6.1.4 Grinding mode/Grinding stop

The START button starts the grinding process (only if the lid is closed). The display indicates the remaining time of the grinding process. When the grinding time has elapsed, the preset time is displayed again.

If the grinding process is interrupted by pressing STOP or opening the hood, the display indicates the remaining grinding duration. When the device is started again, the grinding process is continued according to the remaining duration.

When the grinding duration has elapsed, the mortar stops.

Remember that the grinding stock heats up during grinding. The grinding parameters must be selected depending on the permissible treatment of the grinding stock.

6.2 Selecting the mortar and pestle

When choosing the material for the grinding parts, consider the hardness of the material to be ground and the tolerance of impurities - however small they may be - due to friction with grinding parts.

Mortar and pestle of the following materials can be used:

Material (Mortar and pestle)		Order no. (grinding set)	Abrasion resistance
Mineral materials			
Hard porcelain		46.211.0.00	Sufficient
Sintered corundum	99.7 Al ₂ O ₃	46.2060.00	Fairly good
Agate	99.9 SiO ₂	46.2050.00	Good
Zirconium oxide	94% ZrO ₂	46.2120.00	Very good
Metal materials			
Stainless steel	17-19% Cr + 8-10% Ni	46.2100.00	Fairly good
Tempered steel	11-12% Cr + 1.92 - 2% C	46.2090.00	Good
Stainless steel, monolithic	17-19% Cr + 8-10% Ni	46.2140.00	Fairly good
Tungsten carbide	93% WC + 6% Co	46.2080.00	Very good

**NOTICE!**

If liquid nitrogen is added to the grinding process, it is only permitted with the monolithic stainless-steel grinding set. With mineral materials, there is a great risk of damaging the grinding elements by adding liquid nitrogen.

Grinding with mineral grinding elements and added liquid nitrogen will void the guarantee.

6.3 Installing / removing the grinding set



The grinding parts used in the laboratory mortar mill are made so that the scraper and mortar fit together exactly. For this reason, only use mortars, pestles and scrapers together that match.

Because grinding parts wear faster or slower depending on the load, it may be necessary to readjust the scraper and pestle.

When the lid of the mill is open, it is easy to access the grinding parts.

6.3.1 Installing/removing the mortar

**CAUTION!**

Crushing hazard!

When inserting the mortar!

The mortar is fastened to the carrier with a bayonet catch.



To open the bayonet, rotate the mortar to the left.

To close the bayonet, rotate the mortar to the right.

When the bayonet is open, it is possible to lift the mortar out of the mill.

When inserted, the mortar is installed onto the centre of the support. Rotate the mortar until the bayonet locks into place. When the bayonet has locked into place (the mortar no longer wobbles), turn the mortar to the right to close the bayonet.

Using the device



Note

- Rotation to the right = clockwise rotation
- Rotation to the left = anticlockwise rotation

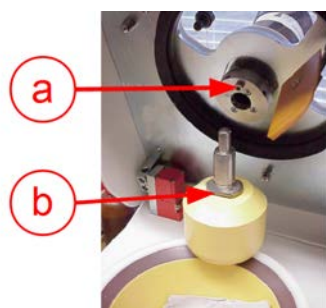
Rotate the mortar in the direction of the arrow to open the bayonet.

6.3.2 Installing/removing the pestle



The pestle is held in place with a catch holder and can be easily removed without tools.

Pull the pestle in the direction of its axis to release it from the catch holder. For this purpose, it is recommended to press fingers (thumbs) against the lid (see picture).




Before installing the pestle, the pestle shaft must be cleaned.

Inserting the pestle shaft into the bearing locks the pestle into its working position again. When inserting the pestle shaft, make sure that one of the milled spanner flats (b) on the pestle is located next to the drive screw (a).

6.3.3 Mounting the scraper



- The scraper included in the scope of delivery has to be screwed to the guide rod before grinding for the first time.
- Place the scraper onto the guide rod, as shown in the picture, and screw it lightly to the rod with the screw in the right hole.
- To set the scraper, refer to chapter  'Setting the scraper' on page 28.

6.4 Setting the grinding pressure



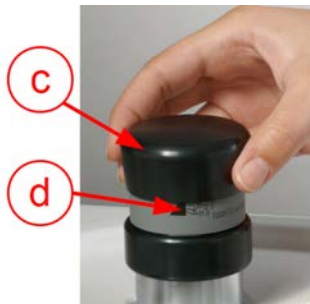
NOTICE!

Before commissioning, it is necessary to adjust (zero position) the pressure scale (see Chapter ↗ 'Adjusting' on page 26)

The contact pressure of the pestle against the wall and bottom of the mortar must be adjusted in two directions.

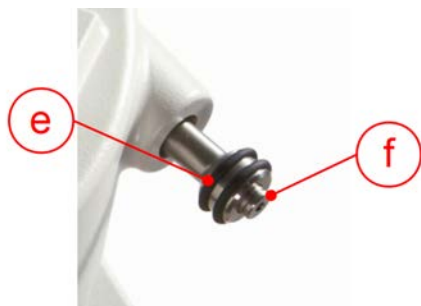
The contact pressure is adjusted with the lid and latch closed.

6.4.1 Positioning the pestle against the bottom of the mortar



The desired contact pressure is set by turning the adjusting nut (c), and its value is read on the scale (d). If the bottom edge of the black adjusting nut (c) is above the Gap (mm) 0 display, the pestle is lifted from the mortar according to the number (6 = 66 mm in the illustration). This is only required for pre-crushing of coarse samples (see Chapter ↗ 'Pre-crushing settings for coarse samples' on page 26). For comminution, the adjusting nut is usually set to a contact pressure [daN Downforce] between 2.5 and 17.5 daN.

6.4.2 Positioning the pestle against the mortar wall



It is positioned radially in relation to the main rotation of the mortar. The desired contact pressure is built up by turning the adjusting screw (e). To do so, turn the screw (e) to the right until the display cylinder is visible (f). The contact pressure can be read on the display cylinder (f). For most applications, the lateral contact pressure is set so that the 1st ring or the 2nd ring is visible.

Read the grinding pressures as follows:

1. ➡ Ring visible ~ 16.5 daN (kg)
2. ➡ Ring visible ~ 20 daN (kg)
3. ➡ Ring visible ~ 23.8 daN (kg)
4. ➡ Ring visible ~ 27.3 daN (kg)

Using the device

6.4.3 Pre-crushing settings for coarse samples

To pre-crush coarse samples of up to 8 mm, the adjusting nut (c) can be raised above the zero position if necessary so that coarse particles fit below the pestle and can be comminuted. (see the illustration under Chapter ↗ *'Positioning the pestle against the mortar wall'* on page 25) For subsequent fine grinding, the pestle is lowered again to the desired position. (Set to contact pressure [daN Downforce] between 2.5 - 17.5 daN)

6.5 Adjusting the vertical pressure scale

On new devices that are delivered with a mortar and pestle, the scale is adjusted to fit the grinding parts and does not need to be readjusted during commissioning.

The scale has to be readjusted if different or new grinding parts are used.

6.5.1 Adjusting



1. ➤ Install the empty mortar (without grinding stock) and fasten it to the carrier plate (see Chapter ↗ *'Installing/removing the mortar'* on page 23)
2. ➤ Insert the pestle into the latch bearing in the lid (see Chapter ↗ *'Installing/removing the pestle'* on page 24)
3. ➤ Close the lid (1) with the latch (5)!
4. ➤ Unscrew the adjusting nut (c) until the pestle is lifted from the bottom of the mortar.
5. ➤ Unscrew the adjusting screw (f) for the lateral pressure setting until it stops.
6. ➤ The pestle is moved to the grinding chamber centre.

Using the device



The zero position of the pressure scale can be determined two different ways:

- Close the lid and its latch. Start the device (START). The adjusting nut (c) is now used to slowly lower the pestle until it touches the bottom of the rotating mortar. When observing the pestle, it is possible to see that the pestle is moved by the contact with the mortar. The scale is now loosened (see illustration) and shifted so that it displays the zero position of the pestle.

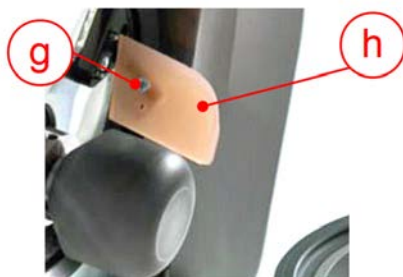
The bottom edge of the black adjusting nut is on the "0" line.

- Dampen a small piece of paper and press it, so it is flat on the bottom of the mortar. (Do not place the paper in the centre but so that it is off-centre).

Close the lid and its latch. Start the device (START). While observing the rotating paper, the adjusting nut (c) is used to slowly lower the pestle until the paper is held back by the pestle. The pestle has now reached the bottom of the rotating mortar. The scale is now loosened and shifted so that it displays the zero position of the pestle.

- Do not release the scale ring! It is only necessary to adjust the zero position if the grinding set is changed.

6.6 Scraper



The fastener (g) of the scraper should not be tightened too firmly so that the scraper can be moved around the Philips screw (g).

The scraper (h) is adjusted with the lid and the latch closed.

Using the device

6.6.1 Setting the scraper



1. Turn the screw to the left.



2. Release the lever.



3. Grip the guide rod.



4. Move the scraper against the wall and onto the bottom of the mortar by turning it to the left.
Turn the screw downward until it rests on the rocker element.

Using the device



5. ➤ Tilt the guide rod while turning the scraper to the left to align it with the guide rod.



6. ➤ Clamp the lever. Then release the guide rod.



7. ➤ Turn the screw to the right to reduce the contact pressure of the scraper against the mortar so that the scraper lightly touches the wall.



It is advisable to adjust the scraper during grinding to check the correct position of the scraper according to the movement of the grinding stock.

Notes on setting the scraper:

- See the illustration under point 5
The angle can be adjusted to fit different grinding stocks.
Rule of thumb: The scraper should almost be aligned with the holder.
The scraper is in a good position when the grinding stock is scraped cleanly from the mortar wall and guided in front of the pestle without a grinding stock jam forming in front of the scraper.
- See the illustration under point 7
Use the screw to set the contact pressure of the scraper. Unnecessarily high contact pressure causes the scraper to wear more rapidly!

Using the device

6.7 Filling the grinding stock / Starting the grinding process

1. ➤ Open the latch of the lid. Open the laboratory mortar mill.
2. ➤ Fill a maximum of 190 ml grinding stock (particle feed size < 8 mm) into the front area of the mortar.
3. ➤ Close the lid of the mill. Secure the lid by closing the latch.
4. ➤ Set the desired contact pressure. Standard setting for most samples: 10-15 daN and lateral contact pressure; the first ring is visible.
5. ➤ Set the desired grinding duration.
6. ➤ Start the laboratory mortar mill by pressing START.
7. ➤ If necessary, adjust the mill settings while the mill is running (see Chapter ➤ *'Setting the grinding pressure' on page 25*).
8. ➤ Scraper fine adjustment:

While grinding, hold the guide rod and release the lever. Move the scraper up and down and to the left to adjust its position to the wall until it rests optimally against it.

6.8 Removing the grinding stock

1. ➤ Stop the grinding process by pressing STOP or wait until the set grinding time has elapsed.
2. ➤ Open the latch of the lid. Open the lid of the laboratory mortar mill.
3. ➤ Release the mortar from the bayonet catch and lift it. Then, position it in the centre under the pestle and (for instance in the case of dry grinding) brush off the remaining fine dust.
4. ➤ Take the mortar out of the mill to empty it. See Chapter ➤ *'Installing / removing the grinding set' on page 23*.

6.9 Grinding with external cooling

For certain grinding stock, adding coolant before grinding can benefit comminution. It is possible, for instance, to make the sample brittle by freezing it with liquid nitrogen (N₂) or in a freezer before grinding it. The grinding stock should, however, be protected against water condensation - e.g. a plastic bag can be used to keep the grinding stock dry during cooling until it is ground.

**NOTICE!**

If liquid nitrogen is added to the grinding process, it is only possible when using the stainless steel grinding set (order no. 462140.00) because the mortar is manufactured from solid material (monolithic). All other grinding sets have a plastic casing, which would be destroyed by adding liquid nitrogen.

The grinding set must be cooled down with liquid nitrogen outside of the PULVERISETTE 2 beforehand. This helps prevent nitrogen from boiling inside the device.

**CAUTION!**

Wear safety goggles and suitable safety gloves when using liquid nitrogen!

For this application, the grinding set is at room temperature, and only the grinding stock has been pre-cooled. It is possible to use grinding sets made of tungsten carbide, stainless steel, zirconium oxide or sintered corundum, because the grinding set is not directly cooled.

For very temperature-sensitive grinding stock or material which is not brittle, we recommend additional cooling with liquid nitrogen. This can be added to the grinding stock in the mortar made of stainless steel directly by filling it into the lid opening in the view window of the mortar mill.

**NOTICE!**

To avoid damaging the plexiglas cover, we recommend inserting a plastic or steel funnel into the lid opening and using it to fill the nitrogen.

For a grinding duration of 5 min., 2 to 3 l liquid nitrogen are required. This is added gradually via the opening in the lid. The sample is constantly immersed in the circulating liquid nitrogen (N₂) during the grinding process.

We recommend not exceeding a maximum grinding duration of 10 to 15 minutes because the cooling effect is transmitted to the bearings and the drives, causing the bearing grease to harden and the pestle to become blocked, for instance. Likewise, the grinding parts should be taken out of the device after grinding so that the bearings can cool back down to ambient temperature. Remove developing water condensation from the grinding chamber.

You can also use dry ice (solid carbon dioxide) for cooling. You should, however, keep in mind that the surface of dry ice often contains frozen condensate, which could potentially mix with your grinding stock causing contamination.

7 Cleaning



DANGER!

Mains voltage!

- Before beginning with cleaning work, disconnect the mains plug and protect the device against being unintentionally switched back on!
- Do not allow any liquids to flow into the device.
- Indicate cleaning work with warning signs.
- Put safety equipment back into operation after cleaning work.



NOTICE!

Grinding stock residues on the edge destroy the lip seal over time!



NOTICE!

Cool grinding elements made of agate, sintered corundum, zirconium oxide and silicon nitride slowly and carefully.

Do not heat agate elements in a microwave under any circumstances (heating is too fast).

They must never be exposed to thermal shocks as this could cause irreparable damage to the parts → They will burst apart like in an explosion.

The mortar mill can be wiped with a damp cloth when it is switched off.

The mortar and the pestle can be taken out of the device for cleaning (see Chapter ↗ *'Installing/removing the mortar' on page 23*).

7.1 Lid seal



9 Seal

The seal (9) in the lid separates the working chamber from the rest of the machine. The seal is simply clamped in a U-channel and can be removed!



NOTICE!

When grinding a sample which produces excessive dust or is projected from the mortar during grinding, it is necessary to use the seal to avoid unnecessary contamination or damage. The seal is not required for grinding stocks which remain in the mortar (e.g. pastes).



Should it be necessary to use the seal, but there are problems with abrasion of the seal (possible with samples which produce large amounts of dust or hot grinding stock), we recommend using the included lubricant.



Apply the lubricant sparsely to the contact surface!

8 Maintenance



DANGER!

Mains voltage

- Before beginning with maintenance work, unplug the mains plug and protect the device against being unintentionally switched back on again!
- Indicate maintenance work with warning signs.
- Maintenance work may only be performed by specialised personnel.
- Put safety equipment back into operation after maintenance or repair work.



We recommend keeping a safety logbook ↗ Chapter 13 'Safety logbook' on page 42, where all work (maintenance, repairs.....) performed on the device is entered.



The most important element of maintenance is regular cleaning:

8.1 Adjusting the vertical pressure scale of the pestle

It is recommended to adjust the scale from time to time depending on the wear of the grinding parts.

8.2 Device

The bearings of rotating parts have permanent lubrication.

Functional part	Task	Test	Maintenance interval
Safety switch	Operator safety	Does the mill stop when the hood is opened?	Before each use
Ventilation slots	Cooling system, electronics	Proper function, clean when soiled	Twice a year

8.3 Resharpener the grinding set

After prolonged use, scratches or irregularities may appear on the surfaces of mortar and pestle, in which grinding stock can get stuck.

It is possible to sharpen the grinding mortar by filling it with approx. 20 g of carborundum (0.5 mm silicon carbide abrasive, grain 60) and operating the laboratory mortar mill in normal grinding mode for a ½ hour. Downforce should be set to 5-10 daN, and the lateral pressure should be set to the 1st ring.

Choose a longer duration for the sharpening process depending on the depth of the scratches and the type of grinding set. Wet grinding with added water is recommended. If it is not possible to obtain abrasives, aluminium oxide (sintered corundum) of the same grain size (0.5 mm) can be used as an alternative.

Repairs

9 Repairs



DANGER!

Mains voltage!

- Before beginning with repair work, unplug the mains plug and protect the device against being unintentionally switched back on.
- Indicate repair work with warning signs.
- Repair work may only be performed by specialised personnel.
- Put safety equipment back into operation after maintenance work.

9.1 Checklist for troubleshooting

Fault description	Cause	Remedy
Mill stops running	Switch-off due to overload / motor blockage	Eliminate the cause, press the safety button again (back of device)
Mill does not run after pressing [START]	Hood not closed	Close hood
	Too much sample material filled	Reduce quantity
	Too coarse, hard grains are blocking the scraper and pestle	Lift the pestle or pre-crush larger grains
No function after switching on the main switch	Line fuse in the mains connection defective	Replace fuses

10 Disposal

It is hereby confirmed that FRITSCH has implemented the directive 2002/95/EC of the European Parliament and Council from 27th January 2003 for the limitation of the use of certain dangerous substances in electrical and electronic devices.

FRITSCH has registered the following categories according to the German electrical and electronic equipment act, section 6, paragraph 1, clause 1 and section 17, paragraphs 1 and 2:

Mills and devices for the preparation of samples have been registered under category 6 for electrical and electronic tools (except for large stationary industrial tools).

Analytical devices have been registered under category 9, monitoring and control instruments.

It has been accepted that FRITSCH is operating only in the business-to-business area. The German registration number for FRITSCH is WEEE reg. no. DE 60198769

FRITSCH WEEE coverage

Since the registration of FRITSCH is classified for bilateral transactions, no legal recycling or disposal process is described. FRITSCH is not obliged to take back used FRITSCH devices.

FRITSCH declares it is prepared to take back used FRITSCH devices for recycling or disposal free of charge whenever a new device is purchased. The used FRITSCH device must be delivered free of charge to a FRITSCH establishment.

In all other cases FRITSCH takes back used FRITSCH devices for recycling or disposal only against payment.

11 Guarantee terms

Guarantee period

As manufacturer, FRITSCH GmbH provides – above and beyond any guarantee claims against the seller – a guaranty valid for the duration of two years from the date of issue of the guarantee certificate supplied with the device.

Within this guarantee period, we shall remedy all deficiencies due to material or manufacturing defects free of charge. Rectification may take the form of either repair or replacement of the device, at our sole discretion. The guarantee may be redeemed in all countries in which this FRITSCH device is sold with our authorisation.

Conditions for claims against the guarantee

This guarantee is subject to the condition that the device is operated according to the instructions for use / operating manual and its intended use.

Claims against the guarantee must include presentation of the original receipt, stating the date of purchase and name of the dealer, together with the complete device type and serial number.

For this guarantee to take effect, the answer card entitled "Securing of Guarantee" (enclosed with the device) must be properly filled out and despatched without delay after receipt of the device and be received by us within three weeks or alternatively, online registration must be carried out with the above-mentioned information.

Reasons for loss of the guarantee

The guarantee will not be granted in cases where:

- Damage has arisen due to normal wear and tear, especially for wear parts, such as: Crushing jaws, support walls, grinding bowls, grinding balls, sieve plates, brush strips, grinding sets, grinding disks, rotors, sieve rings, pin inserts, conversion kits, sieve inserts, bottom sieves, grinding inserts, cutting tools, sieve cassettes, sieve and measuring cell glasses.
- Repairs, adaptations or modifications were made to the device by unauthorized persons or companies.
- The device was not used in a laboratory environment and/or has been used in continuous operation.
- Damage is present due to external factors (lightning, water, fire or similar) or improper handling.
- Damage is present that only insubstantially affects the value or proper functioning of the device.
- The device type or serial number on the device has been changed, deleted, removed or in any other way rendered illegible
- The above-mentioned documents have been changed in any way or rendered illegible.

Guarantee terms

Costs not covered by the guarantee

This guarantee excludes any costs for transport, packaging or travel that accrue in the event the product must be sent to us or in the event that one of our specialist technicians is required to come to your site. Any servicing done by persons not authorised by us and any use of parts that are not original FRITSCH accessories and spare parts will void the guarantee.

Further information about the guarantee

The guarantee period will neither extend nor will a new period of guarantee begin in the event that a claim is placed against the guarantee.

Please provide a detailed description of the type of error or the complaint. If no error description is enclosed, we shall interpret the shipment as an assignment to remedy all recognisable errors or faults, including those not covered by the guarantee. Errors or faults not covered by the guarantee shall in this case be rectified at cost.

We recommend reading the operating manual before contacting us or your dealer, in order to avoid unnecessary inconvenience.

Ownership of defective parts is transferred to us with the delivery of the replacement part; the defective part shall be returned to us at buyer's expense.



NOTICE!

Please note that in the event that the device must be returned, the device must be shipped in the original Fritsch packaging. Fritsch GmbH denies all liability for any damage due to improper packaging (packaging not from Fritsch).

Any enquiries must include a reference to the serial number imprinted on the type plate.

12 Exclusion of liability

Before using the product, be sure to have read and understood this operating manual.

The use of the product requires technical knowledge; only commercial use is permitted.

The product may be used exclusively within the scope of applications set down in this operating manual and within the framework of guidelines put forth in this operating manual and must be subject to regular maintenance. In case of non-compliance, improper use or improper maintenance, the customer assumes full liability for the functional capability of the product and for damage or injury arising from violating these obligations.

The contents of this operating manual are subject in entirety to copyright law. This operating manual and its contents may not be copied, further distributed or stored in any form, in part or in whole, without the prior written consent of Fritsch.

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Not all parts shown here are necessarily installed in the product. The buyer is not entitled to delivery of these parts. If interested, please contact your local FRITSCH GMBH distributor or Fritsch GmbH, Industriestr. 8, D-55743 Idar-Oberstein.

FRITSCH GMBH takes the greatest care to ensure that the quality, reliability and safety of your products are continuously improved and adapted to the state of the art. The supplied products as well as this operating manual conform to the current state of the art when they leave the sphere of influence of FRITSCH GMBH.

By using the product the customer agrees with this and recognizes that defects, malfunctions or errors cannot be completely excluded. To prevent risk of damage to persons or property or of other direct or indirect damage, resulting from this or other causes, the customer must implement sufficient and comprehensive safety measures for working with the product.

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No permission is given expressly, implicitly or otherwise for the use of patents, brands or other copyrights. We also assume no liability for copyright infringements or infringements of the rights of third parties arising from the use of this product.

Neither compliance with this operating manual nor the conditions and methods used during installation, operation, use and maintenance of the product can be monitored by Fritsch GmbH. Improper execution of the installation can result in property damage and thus endanger persons. Therefore, we assume absolutely no responsibility or liability for loss, damage or costs that result from errors at installation, improper operation or improper use or improper maintenance or are in any way connected to these.

Safety logbook

13 Safety logbook

Date	Maintenance / Repair	Name	Signature

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